OPERATING HANDBOOK

MC-50

METER CALIBRATOR

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INTRODUCTION

The Wavetek Model MC-50 is a controlled-output signal source which can be used as a signal generator, marker generator, or signal level meter calibrator. Significant functional features of the Model MC-50 include: -30 to +50 dBmV output level range with a 1 dB resolution and ±.25 dB flatness at +50 dBmV; AM capability with either a 400 Hz tone or simulated horizontal blanking pulses; and an auxiliary output suitable for driving a frequency counter. Model MC-50 covers the 4 to 400 MHz frequency range in two bands (4 to 200 and 200 to 400 MHz). A fune tuning control provides ±1 MHz vernier adjustment of frequency.

SPECIFICATIONS

RF OUTPUT FREQUENCY

Range	4 to 400 MHz continuously adjustable in two bands (4 to 200 and 200 to 400 MHz)
Fine Tuning Control Range	± ⩾ 1 MHz

RF OUTPUT LEVEL

Range	-30 to +50 dBmV in 1 dB steps
Accuracy at +50 dBmV (Flatness)	±0.25 dB
10 dB/Step Attenuator Accuracy	±0.5 dB
1 dB/Step Attenuator Accuracy	±0.2 dB
Band Differential at 200 MHz	±0.25 dB

COUNTER OUTPUT LEVEL

+40 dBmV nominal

MODULATION

Tone	400 Hz nominal; 80% AM typ
TV	15,750 Hz ±8% (63 ±5 μsec); 80% AM typ; 10 ±1 μsec duty cycle

CONNECTORS	Type F
GENERAL	
Power	115 VAC ±10%, 50-60 Hz, 40 W
Dimensions	6½ in high x 11 in wide x 11 in deep
Weight	11 lbs.

DESCRIPTION OF FRONT PANEL

Refer to Figure 1.

(1) FREQUENCY control adjusts the RF output frequency. The dial is graduated in 5 MHz increments on low band, 10 MHz increments on high band.

(2) FINE TUNE control provides ±1 MHz adjustment of RF output frequency.

(3) OUTPUT LEVEL controls set the RF output level with 1 dB resolution. Output level is the algebraic sum of the two control indicators.

(4) RF OUT connector provides connection for the RF output signal.

(5) METER will indicate "CAL" when the Model MC-50's output level as shown on the OUTPUT LEVEL control indicators is accurate.

(6) BAND pushbutton switch selects the low (4 to 200 MHz) or high (200 to 400) band of the FREQUENCY control.

(7) POWER pushbutton switch applies AC power to the power supply.

(8) MODULATION pushbutton switch enables the TV/TONE switch for amplitude modulation.

(9) TV/TONE selects either simulated horizontal blanking pulses or a 400 Hz square wave for amplitude modulation.

DESCRIPTION OF REAR PANEL

Refer to Figure 2.

(1) AC INPUT provides connection to AC mains via three-conductor line cord.

(2) FUSE is 1 amp, time delay.

(3) COUNTER OUT connector provides +40 dBmV output for use by a frequency counter.

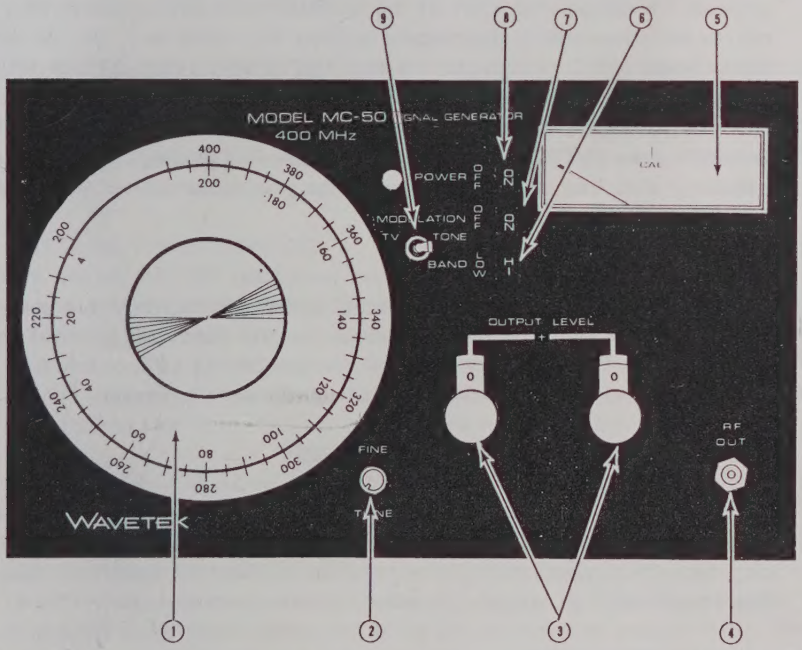

Figure 1. Front Panel

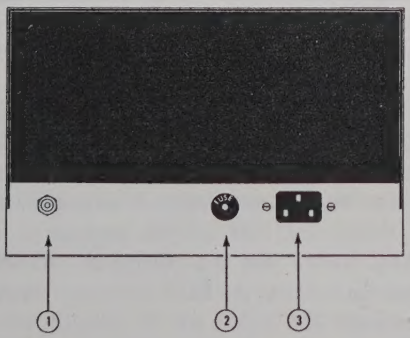

Figure 2. Rear Panel

GENERAL OPERATION

Basic operation of the Model MC-50 is relatively simple. RF output frequency is set via the BAND pushbutton switch and the FREQUENCY and FINE TUNE controls. RF output level is set via the two OUTPUT LEVEL controls, with the control indicators adding algebraically to show the output level (i.e., 20 on the left indicator and 7 on the right indicator add up to +27 dBmV; -10 on the left indicator and 7 on the right indicator add up to -3 dBmV). Modulation is activated via the MODULATION pushbutton switch, with the type of modulation selected via the TV/TONE switch. If a high-resolution reading of the RF output frequency is desired, a frequency counter may be connected to the rear-panel COUNTER OUT connector.

When the instrument is operating, the front-panel METER should indicate "CAL" at all times. If it does not, the instrument's internal level control circuit has become unleveled or is out of alignment, and the RF output level indication is probably not accurate. The cause of the non-CAL condition should be determined and corrected before proceeding with the work in progress.

SIGNAL LEVEL METER ALIGNMENT NOTES

First, check that the signal level meter (SLM) is operating properly and needs only alignment and not repair. A few quick checks can save much time. Once these checks are performed, alignment of the SLM can be performed in accordance with the SLM's operating handbook or instruction manual.

ATTENUATOR CHECKS

The input attenuator is the main amplitude control in an SLM. SLM attenuators have three main sources of error or inaccuracy. Individual attenuator pads may be defective or fail; the pad values may vary excessively with frequency; and errors from individual pads may accumulate (or excessive leakage may occur) so that the entire attenuator is out of specification.

Connect the Model MC-50 RF OUT connector to the SLM input and set the Model MC-50 for -30 dBmV output level at 50 MHz (no modulation). Tune the SLM for an indication on its meter. Switch in an attenuator pad on the SLM and adjust the Model MC-50 OUTPUT LEVEL controls to reproduce the previous SLM meter reading. Verify that the change in the Model MC-50 OUTPUT LEVEL control settings matches the SLM attenuator value within the attenuator accuracy specifications.

Repeat the above procedure for all SLM attenuator settings. Also repeat the above procedure for a Model MC-50 frequency of 220 MHz (or any other desired frequency). If the SLM attenuator is not within its accuracy specifications, it must be replaced or repaired before the SLM can be properly aligned.

LEVEL MEASUREMENT CHECK

Set the Model MC-50 OUTPUT LEVEL controls for a +10 dBmV output at 50 MHz and measure the level with the SLM. Repeat the measurement at 220 MHz. The SLM should read between +5 and +15 dBmV at each frequency. If it does not, the SLM is severely out of alignment (and thus needs a complete IF sweeping and alignment) or in need of repair.

METER MOVEMENT CHECK

Vary the Model MC-50 OUTPUT LEVEL controls in 1 dB steps such that the SLM meter movement is exercised throughout its range. Watch for any evidence of a sticky or uneven movement. Return occasionally to the original OUTPUT LEVEL control setting and note the SLM reading. If the SLM does not give the same reading each time, the SLM meter movement may be sticking.

CW/MODULATION ALIGNMENT NOTES

Most SLMs have meter range adjustments for both the high and low ends of the scale. If these are set using a CW input signal, the SLM meter reading will not be correct when measuring a modulated video carrier. If these are set using a modulated input signal, pilots and audio carriers will not read correctly. The decision as to which type of input signal to use should be based on the types of signals which will be measured in actual use of the SLM. It may be desirable to set the adjustments alternating between modulated and CW signals (using the Model MC-50's MODULATION pushbutton switch) and splitting the difference between the readings. This will generally produce an error on both modulated and CW signals of $\sim \pm 0.5$ dB.

MODEL MC-50 ALIGNMENT

The following alignment procedure assumes that the Model MC-50 is operating properly. Refer to Figure 3 for internal test point and adjustment locations.

OUTPUT FREQUENCY

Connect a frequency counter to the Model MC-50 RF OUT connector and tune the Model MC-50 throughout its range to verify that the instrument is

MC-50-400
SIGNAL GENERATOR
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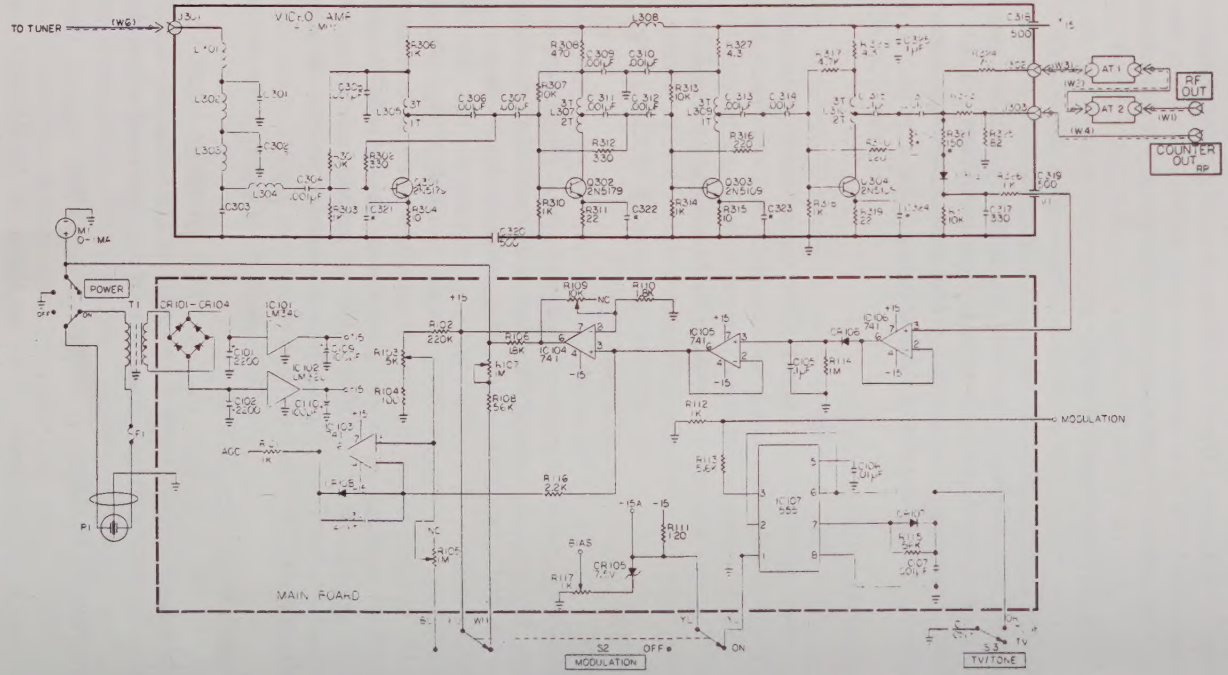
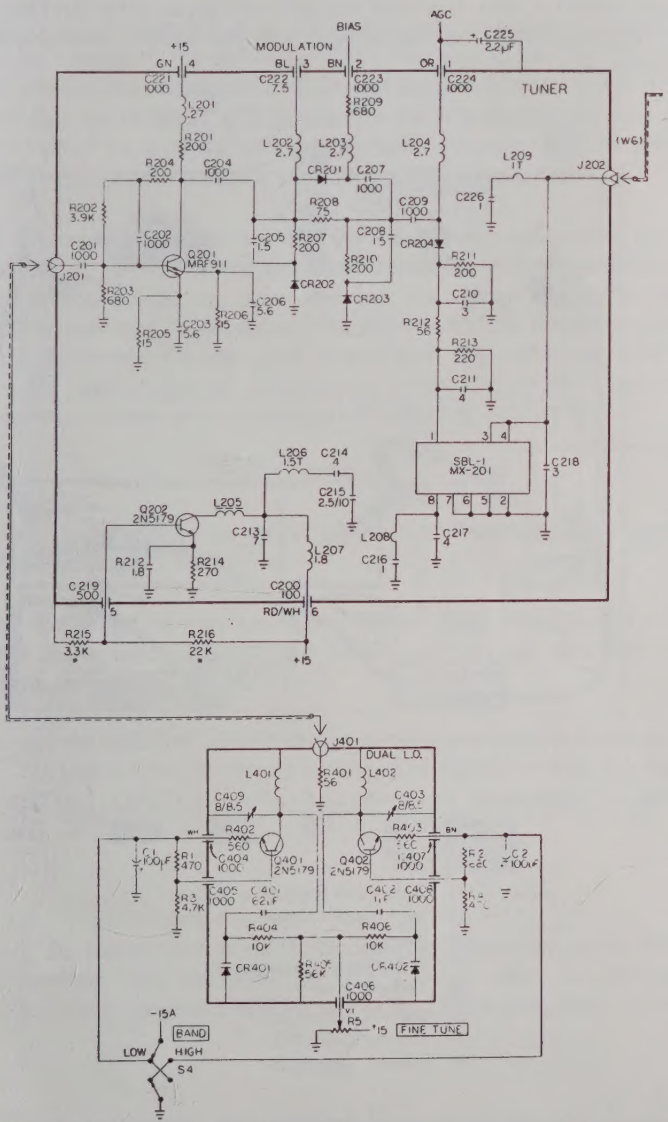
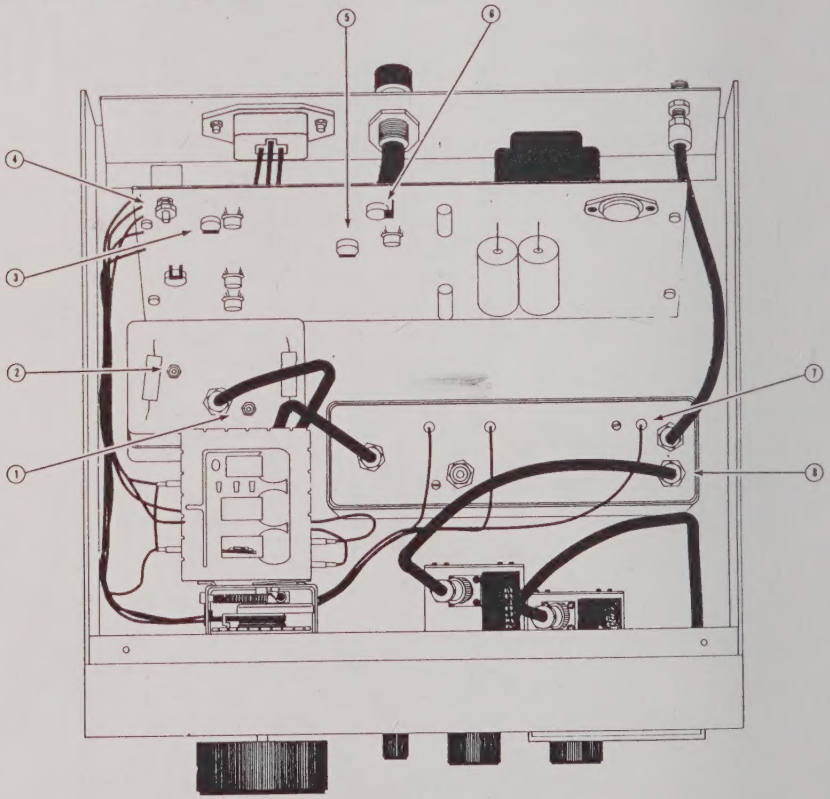



BIAS
AGC
+15
MODULATION
C225 2.2μF
GN 4
BL 3
BN 2
OR 1
C221 1000
C222 7.5
C223 1000
C224 1000
TUNER
L201 .27
R209 680
R201 200
L202 2.7
L203 2.7
L204 2.7
(W6)
L209 1T
J202
R204 200
C204 1000
CR201
C207 1000
C226 1
R202 3.9K
R208 75
C209 1000
C202 1000
C205 1.5
R207 200
C208 1.5
CR204
C201 1000
J201
Q201 MRF911
R210 200
R211 200
CR202
CR203
C206 5.6
C210 3
R203 680
R206 15
C203 5.6
R205 15
R212 56
R213 220
C211 4
L206 1.5T
C214 4
SBL-1 MX-201
C218 3
C215 2.5/10T
Q202 2N5179
L205
C213 7
L208
C217 4
R212 1.8
R214 270
L207 1.8
C216 1
C219 500
C200 100
5
RD/WH
6
R215 3.3K
R216 22K
+15
J401
DUAL L.O.
L401
R401 56
L402
C409 8/8.5
C403 8/8.5
WH
R402 560
R403 560
BN
C1 .001μF
R1 470
C404 100
Q401 2N5179
Q402 2N5179
1407 1000
R2 560
C2 .001μF
C405 1000
C401 .22μF
C412 1μF
C408 1000
R3 4.7K
R4 4.7K
R404 10K
R406 10K
CR401
R405 5.6K
CR402
C406 1000
V1
R5
+15
FINE TUNE
-15A
BAND
LOW
HIGH
S4

operational at all frequencies wthin its range. Select specific frequencies with the FREQUENCY dial and verify that the output frequency matches the selected frequency within 5 MHz. If it does not, carefully adjust either the Low or High Band Frequency Adjust (as appropriate) until the counter readings are within specification at all frequencies.



(1) Low Band Frequency Adjust
(2) High Band Frequency Adjust
(3) Output Level Max
(4) Modulated Output Level
(5) Meter Cal Set
(6) Meter Cal Mod Set
(7) Coaxial Cable W3
(8) Leveler Test Point

Figure 3. Internal Test Points And Adjustments

OUTPUT LEVEL

Disconnect Coaxial Cable W3 at its Attenuator end and connect a power meter (75 ohm impedance) to the open end of W3. The level should be ~50 dBmV. Reconnect W3 to the Attenuator and connect the power meter to the RF OUT connector. Set the OUTPUT LEVEL controls for +50 dBmV. The level should be within 1 dB of the level read at W3. If the levels are more than 1 dB different, one of the Attenuators or a coaxial cable (W1 or W2) is defective.

Connect the power meter to the RF OUT connector and set the OUTPUT LEVEL controls for +50 dBmV (no modulation). Connect an oscilloscope or voltmeter to the Leveler test point and note the voltage (~0.5 V). Set the TV/TONE switch to TV and depress the MODULATION pushbutton switch. Adjust the Modulated Output Level control such that the Leveler test point voltage is the same as for the unmodulated output. Adjust the Output Level Max control for a power meter reading of +50 dBmV (1.3333 mW).

NOTE

If a 50 ohm impedance power meter with a 6 dB matching pad is used, the power meter reading is 0.34 mW.

Since the Modulated Output Level and Output Level Max controls interact, repeat the above procedure until the correct readings are obtained without further adjustment of the controls.

Step through the OUTPUT LEVEL control settings and verify the operation and accuracy (±0.5 dB for the 10 dB/step control; ±0.2 dB for the 1 dB/step control) of the OUTPUT LEVEL controls. Also check for intermittent or defective control steps.

METER

Disconnect the oscilloscope or voltmeter from the Leveler test point. Note the METER reading. Vary the FREQUENCY control within the instrument's specified frequency range and verify that the METER reading does not change.

NOTE

When rapidly varying the FREQUENCY control, the METER reading may momentarily vary, but should always settle to the original reading.

With the MODULATION pushbutton switch set to "OFF", adjust the Meter Cal Set control such that the METER indicator bisects the "CAL" marker. Turn the MODULATION pushbutton switch on and adjust the Meter Cal Mod Set control such that the METER indicator bisects the "CAL" marker.

MP MASTER
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